

Prevalence of pharmacologically treated diabetes among fund beneficiaries of the national social insurance of salaried workers in Algeria

La prévalence du diabète traité pharmacologiquement chez les bénéficiaires de la caisse nationale des assurances sociales des travailleurs salariés en Algérie

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SUMMARY

CONTEXT: The National Social Insurance Fund for Salaried Workers (NSIF) in Algeria has a database where all reimbursed services including the identification are recorded, in the form of codes, of the anti-diabetic drugs reimbursed to NSIF beneficiaries (insured social security and their beneficiaries)

PURPOSE: To determine the prevalence of diabetes, among the insured population and their beneficiaries pharmacologically treated and reimbursed over a period of five years ranging from 2010 to 2014.

METHODS: This is a retrospective pharmacoepidemiological study carried out over a period of five years from 2010 to 2014 throughout Algeria. The collection of information procedure consisted of launching a series of computer queries configured on the basis of the national data from the NSIF

RESULTS: The study allowed us to determine the overall prevalence of pharmacologically treated diabetes (PTD) at 3.98% (5.45% at the end of 2014), in the population of NSIF beneficiaries, of which 4.53% female and 3, 37% male. Stronger in diabetics treated with Oral Hypoglycemic Agents (OHA) alone and those combining insulin unlike diabetics treated only by insulin alone. In adults over 20 years of age, the number of diabetics treated with all combined therapeutic modalities, stopped at the end of December 2014, was 1 316 356 (1 722 103 in the general Algerian population). A geographic disparity was found for the prevalence of PTD with an increasing South - North gradient. These various figures confirm the data of certain studies carried out in Algeria which predicted a significant increase in diabetes as well as forecasts of the World Health Organization (WHO) and the International Diabetes Federation (IDF) which heralded the unremitting progression of the diabetes epidemic in recent years.

KEYWORDS: Diabetes in Algeria, prevalence, pharmacological treatment, NSIF.

RÉSUMÉ

CONTEXTE : la Caisse Nationale des Assurances Sociales des Travailleurs Salariés(CNAS) en Algérie a une base de données où sont enregistrées toutes les prestations remboursées y compris l'identification, sous forme de codes, des médicaments antidiabétiques remboursés aux bénéficiaires CNAS (assurés sociaux et leurs ayants droit).

Objectif : Déterminer la prévalence du diabète, chez la population assurée sociale et leurs ayants droit traités pharmacologiquement et remboursés durant une période de cinq années allant de 2010 à 2014.

MÉTHODES : Il s'agit d'une étude rétrospective pharmaco épidémiologique réalisée durant une période de cinq années allant de 2010 à 2014 sur l'ensemble du territoire algérien. La procédure de recueil d'information a consisté à lancer, une série de requêtes informatiques paramétrées sur la base de données nationale de la CNAS

RÉSULTATS : L'étude nous a permis de déterminer la prévalence globale du diabète traité pharmacologiquement (DTP) à 3,98 % (5,45 % en fin 2014), dans la population des bénéficiaires CNAS dont 4,53 % de sexe féminin et 3,37 % de sexe masculin. Plus forte chez les diabétiques traités par ADO seuls et ceux associant de l'insuline contrairement aux diabétiques traités uniquement par insuline seul. Chez les adultes âgés de plus de 20 ans, l'effectif des diabétiques traités toutes modalités thérapeutiques confondues, arrêté en fin décembre 2014, était de 1 316 356 (1 722 103 dans la

population générale Algérienne). Une disparité géographique était retrouvée pour la prévalence du DTP avec un gradient croissant Sud - Nord.Ces différents chiffres confirment les données de certaines études faites en Algérie qui prévoyaient une hausse sensible du diabète ainsi que les prévisions de l'Organisation Mondiale de la Santé et de la Fédération Internationale du Diabète qui annonçaient, depuis quelques années, la progression inlassable de l'épidémie du diabète.

MOTS CLÉS : Diabète en Algérie, prévalence, traitement pharmacologique, CNAS.

INTRODUCTION

The databases of the National Social Insurance Fund of Salaried Workers (NSIF), Algeria's main insurance fund, where all reimbursed services are recorded, including the identification, in the form of the code, of anti-diabetic drugs reimbursed to NSIF beneficiaries (insured persons and their beneficiaries), are not exploited. However, the analysis of these data would make it possible to study, at the national level, the indicators related to the epidemiological characteristics of PTD. In Algeria, the few studies that were performed to determine the prevalence of diabetes, to evaluate the control and estimate the cost of care were fragmented studies and concerned but certain internal medical services or diabetology, give the realization of national epidemiological surveys are cumbersome and complex. This is why we carried out a pharmacoepidemiological study from a pre-recorded database to determine the prevalence of PTD in Algeria.

MATERIALS AND METHOD

STUDY DESIGN: This is a cross-sectional pharmacoepidemiological study of PTD over a period of five-year ranging from 2010 to 2014 on NSIF's national digital databases relating to reimbursements for anti-diabetic drugs, at least three times a year, on three different dates, to NSIF beneficiaries, of all ages and sexes combined at the national level.

INFORMATION GATHERING: The information gathering procedure consisted of launching a series of computer queries configured on the national NSIF database where all services reimbursed to social insured and their beneficiaries are recorded, including precise identification, in the form codes, reimbursed drugs. The algorithm used in our study, thanks to the relationship "bi-unequivocal" between diabetic pathology and reimbursed anti-diabetic drug, enabled us to classify patients according to the therapeutic methods used, into three categories:

- Diabetics treated with OHA alone
- Diabetics treated with insulin alone
- Diabetics treated by the OHA +Insulin combination

DATA ANALYSIS: The following data were taken into account:

- The total cumulative number of patients who have benefited from at least three anti-diabetic drugs reimbursements, all anti-diabetic modalities combined, by age group, sex, by department and per year,i.e. from January 01st 2010 to December 31st 2014.
- The total cumulative number of patients who have benefited from at least three reimbursements of OHA alone, insulin alone, combinations of OHA and insulin, by age, sex, department and per year,i.e. from January 01st 2010 to December 31st 2014. The data from our study were validated and checked within our very study source (NSIF), because they represent an accounting document with the NSIF services within the framework of the «Third Party Payer» agreement system. The use and processing of data were provided by the SQUIPE -SQL software. The results of our work were determined without confidence intervals because the population included in our study is not a sample but is similar to an exhaustive population.

RESULTS

Our study allowed us to determine the indicators linked to the epidemiological characteristics of PTD in terms of prevalence among NSIF beneficiaries nationwide during the period from 2010 to 2014. The overall prevalence of PTD was 3.98% all treatment modalities and all ages combined, i.e. a number rising from 653 980 in 2010 (Prevalence = 2.65%) to 1 333 879 in 2014 (prevalence = 5.45%), more marked in female diabetics (Tab 1).

Table 1: Numbers of diabetics treated pharmacologically and NSIF beneficiaries, from 2010 to 2014 and rate of global and specific prevalence per year and by sex of diabetes treated all therapeutic modalities and all ages combined, for 100 NSIF beneficiary

	2010	2011	2012	2013	2014		
NSIF beneficiaries	24 645 171	24 848 773	25 135 306	24 997 953	24 473 122	Global prevalence	
treated Diabetics	653 980	822 860	978576	1 150 982	1 333 874		
PTD Prevalence	2.65	3.31	3.89	4.60	5.45	3.98	
PTD Prevalence According to the sex	M	2.25	2.83	3.31	3.87	4.60	3.37
	F	3.02	3.74	4.42	5.27	6.20	4.53

In adults of our population study, aged 20 years and over, the number of diabetics treated, all therapeutic modalities combined, stopped at the end of December 2014, was 1 316 356 of which 531 332 males and 785 024 females with a prevalence of 8.1% and a sex ratio of 0.79 (Tab 2).

Table 2: Number of diabetics treated at all therapeutic modalities combined and rate of global and average prevalence by sex and by age for 100 NHIF beneficiaries aged 20 years and over stopped at the end of December 2014.

Class	Male		Female		Total number	
	Number	specific Prevalence %	Number	specific Prevalence %	Number	specific Prevalence %
Age						
20 - 44	63161	1.43	111022	2.11	174183	1.80
45 - 64	249102	11.56	357178	14.33	606280	13.05
65 - 74	114029	20.99	164963	27.52	278992	24.42
≥ 75	105040	29,27	151861	33,12	256901	31,43
Cumulative number	531 332		785 024		1 316 356	
Gross prevalence	7,12		8,93		8,1	

The overall prevalence of PTD increases sharply with age, regardless of the treatment used (Fig1). This increase begins as early as the age of 20-44 (P=1.80%) and becomes more pronounced from 45 years to reach a maximum in patients over 75 years of age where it stands at 31.43%, as to say one diabetic treated for three NSIF beneficiaries in this age group (Tab 2).

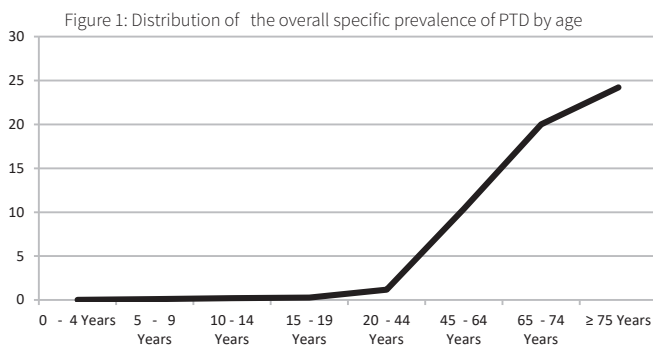


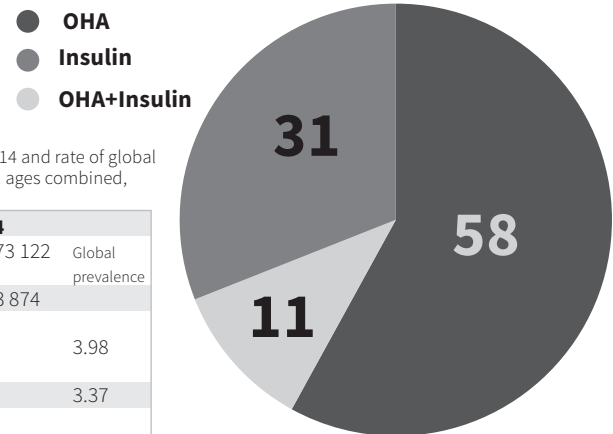
Figure 1: Distribution of the overall specific prevalence of PTD by age

Stronger in diabetics treated with OHA alone (prevalence = 2.28%) and those combining insulin (prevalence = 1.21%) unlike diabetics treated only with insulin alone (prevalence = 0.42%) (Tab 3, Fig 2).

Table 3: Distribution of prevalence of PTD by treatment modality and by year

	2010	2011	2012	2013	2014	Total
OHA	1,32	1.73	2,19	2,75	3,42	2,28
Insulin	0,29	0,37	0,42	0,47	0,55	0,42
OHA+Insulin	1,04	1,18	1,03	1,37	1,46	1,21

Figure 2: Distribution of the overall specific prevalence of diabetes treated by treatment modality.



This prevalence by treatment modality varies according to sex, globally, diabetics treated with OHA alone and those combining insulin and OHA are much more often female (sex ratio 0.75 and 0.63), whereas on contrary, there was a slight male preponderance (sex-ratio 1.09) in diabetics treated exclusively with insulin (Tab 4).

Table 4: Breakdown of the overall specific Prevalence by treatment modality and by sex

	OHA	Insulin	OHA + Insulin
Male	1,94 %	0,45 %	0,98 %
Female	2,57 %	0,41 %	1,55 %
Sex ratio	0.75	1.09	0.63

*The specific overall prevalence by treatment modality also varies according to age regardless of the either anti-diabetic treatment used, It is maximum for the three therapeutic modalities in NSIF beneficiaries aged 75 years and over, while there is an increase in insulin-only treatments from the age of 64, unlike the other two therapeutic modalities (OHA and OHA + Insulin) whose increase is more marked from age 45 (Fig3).

Figure 3: Evolution of the overall prevalence of PTD by Treatment modality and by age.

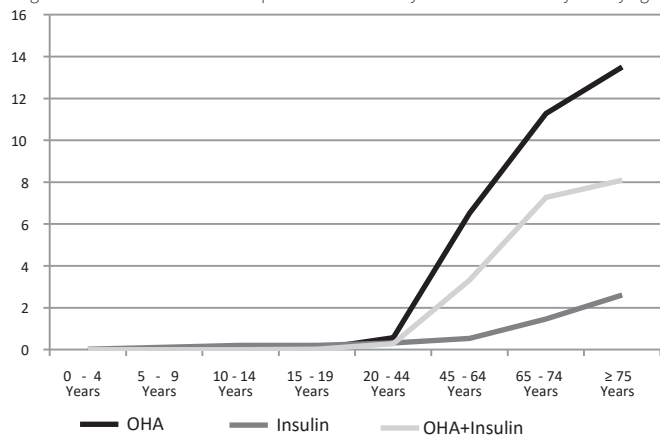


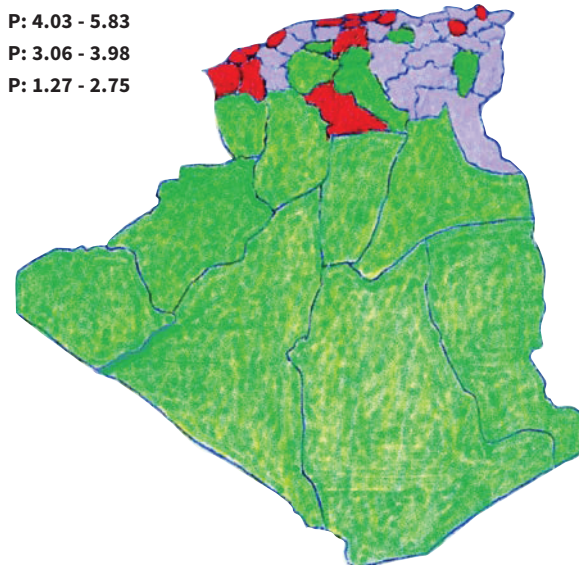
Table 5: Distribution of overall prevalence of PTD by department

Department	Prevalence	Department	Prevalence	Department	Prevalence
Tlemcen	5.83	Bejaia	3.96	Msila	3,11
Annaba	5,37	Skikda	3.94	Saida	3.06
Blida	4.90	Guelma	3.82	Bechar	2.75
Constantine	4.73	Rélizane	3.76	Tiaret	2.71
Alger	4.73	Mila	3.76	B.B.Arreridj	2.58
Oran	4,58	Bouira	3.66	Khenchla	2.41
Tizi- Ouzou	4,53	Mascara	3.63	Gharðaia	2.38

Tipaza	4.51	Ain-Defla	3.58	Tissemsilt	2.36
Boumerdes	4,28	Batna	3.56	Djelfa	2.32
S.B.Abbes	4,23	Jijel	3.54	Naâma	2.27
Laghouat	4.15	El Taref	3.52	Adrar	2.21
Mostaganem	4,06	Tébessa	3.51	El Bayad	2.12
Médéa	4.04	El Oued	3.44	Ouargla	2.04
Ain- Témouchent	4,03	Chlef	3.38	Tamanrasset	1.98
O E Bouagui	3.98	Sétif	3.29	Tindouf	1.51
Souk Ahras	3.96	Biskra	3.24	Illizi	1,27

department analysis of overall prevalence rates of PTD, during our study period, revealed a significant geographical disparity between the south, the interior and north of Algeria, with a maximum of 5.83% in the north and a minimum of 1.27% in the south. This prevalence was higher in the North-West and North-Central, unlike the North-East region where the overall prevalence varies between 2% and 4% with an increasing South-North gradient (Tab 5 and Fig 4).

Figure 4: Geographical disparity by department of the specific prevalence of PTD



DISCUSSION

The Comparison of the data of our study remains highly limited, in the absence of work in Algeria on PTD across all ages and nationally. However, despite differences in methodology, concerning the mode of data collection, but also on the diagnostic criteria and the proposed definitions of the disease. Our study has enabled us to update the national data in the epidemiology of diabetes without resorting to the mobilization of heavy and significant resources. The prevalence rate of PTD for all therapeutic modalities and all ages is 5.45% (n = 1 333 874 diabetics treated) in the only population of NSIF beneficiaries estimated at 24 473 122 at the end of 2014.

This prevalence rate by applying the prevalence data by age group to the age structure of the general population was 4.46% in the general Algerian population estimated at 39 114 275, or 1 746 809 diabetics treated including 1 722 103 aged 20 and over (P=6.94%). The various sample studies published in Algeria over the past thirty years, located the overall prevalence of diabetes, all treatment modalities combined, in adults, in a range between 6.6% and 12.29% 1-10. These studies were the subject of a systematic review which located the prevalence of diabetes at 7.29% for the 20-79 age group for an estimated number of 1 082 628 diabetics in 200811.

The difference between the prevalence rate of our study for diabetics of the same age group in 2014, general population (6.94%) and that of 2008 (7.29%) is probably linked to an overestimation of the prevalence of diabetes in adults in Algeria by classical epidemiological studies on sample, estimated to be of low quality by IDF12 and whose results often differ from the methodologies used (method of collecting information and diagnostic criteria).

However, the rate of the prevalence of PTD for all treatment modalities in the general population (4.46% in 2014) of our study, is very close to estimates in France (4.6% in 2012)13-15.

However, the increasing trend in the prevalence of PTD found in our study during the period from 2010 to the end of 2014 reflects the significant increase in the number of diabetic patients that all studies predicted and reported regularly^{11,16-19}. This increase can be explained both for sociological reasons linked to the change in the way of life of Algerian society which tends to go more and more, westernized, and for demographic reasons such as the extension of the lifetime. It is also possible that better screening has reflected in recent years, a significant increase in the number of diabetics treated¹¹ without forgetting the generalization of the card CHIFA since 2010, which has enabled better recruitment of diabetics. The analysis of the results of our study in relation to sex, relating to the prevalence of diabetics treated pharmacologically, all therapeutic modalities and all ages combined, reveals differences with a sex ratio of 0.74 in December 2014, a period when the predominance of diabetics of female is highest for the 20 - 44 age group with a sex ratio of 0.67. This sex ratio, calculated at the same time in the general population, is 0.84, almost equal to the sex ratio (0.82), identified in the MICS3 study in 20088 in women aged 15 to 49, unlike data from various other sample studies published in Algeria which do not show any gender difference in diabetics¹¹. The predominance of treated diabetic women found in our study could result, at least partially from the fact that women have a greater propensity to treat themselves. They seem moreover more affected by chronic diseases than men, with respectively 17% versus 11% according to data from the MICS4 study¹⁰.

This sexual dysmorphism in diabetes is also found in countries in the sub-Saharan region and in France where the prevalence of diabetes pharmacologically treated is higher in women of Magrebian origin and residents in the French overseas departments, unlike the original metropolitan French women¹⁵. This sexual disparity could be linked, in part to a high genetic risk, to the unfavorable socio-economic conditions, a particular lifestyle and a high prevalence of obesity, major risk factor for diabetes^{14,15}. This higher prevalence of diabetes in women than in men was also been highlighted by IDF in 2018¹² about data from North Africa and the Middle East.

According to the results of our study, female diabetics are treated much more than those male, especially for the 20-64 age group. Male diabetics, aged between 20 and 64, might be less diagnosed, treated late and mainly with insulin alone and probably diagnosed at the stage of complications. The data from our study confirms the increase with the age in the prevalence of treated diabetes as estimated by various studies in Algeria and internationally^{5, 9-12, 16-20}. The data from our study concerning the distribution of antidiabetic therapies confirm the data published in Algeria and around the world relating to the typology of diabetes where type 2 diabetes is predominant^{11,12}. Indeed, more than half of people treated for diabetes during the period of our study had used OHA alone (58%).

Geographical variations in the prevalence of diabetes in Algeria should be discussed in the light of not yet available data on the domiciliation of NSIF beneficiaries in relation to their place of residence and not with regard to the address of their employers as designed by social security. Indeed, this domiciliation bias of insured persons and their dependents can overestimate or, on the contrary, underestimate the real values of the regional distribution of pharmacologically treated diabetes in Algeria. However, in our study, the analysis of the distribution by region of gross prevalence of pharmacologically treated diabetes reveals disparity an important geographical disparity between the south, interior and north of Algeria. These rates increase according to a South-North gradient, going from a low prevalence of 1.27% (Illizi) at the South to a maximum prevalence of 5.83% (Tlemcen) in northern Algeria. Indeed, these results are supported by various studies published in Algeria, especially among the Touareg, with a low rate of 1.3%²¹ and in the Tlemcen region with a high rate of overall prevalence of diabetes which was estimated at 14.2%⁷ and in the TAHINA1 study which estimated a low prevalence rate of diabetes in the south and a higher one in the highland region than that of the Tell.

STRENGTHS AND LIMITATIONS OF THE STUDY: Our retrospective study is based on an observation of benefits reimbursed to chronic patients. By selecting patients who have reimbursed anti-diabetic drugs, at least three times a year, on three different dates, during the period from 2010 to 2014 at nationwide scale, it is undoubtedly lawful to assimilate these patients to a diabetic population. However, the NSIF information system does not allow the identification of diabetics balanced by the only hygienic-dietary measures or undiagnosed diabetics whose number is difficult to assess, let alone treated diabetics who are cared of by the other social security body (Fund of no salaried workers) and those whose support is provided by the social security for the military. Patients who have no social security coverage are, in principle, covered by the NSIF, as part of social safety net (poor population) when they are suffering from a chronic disease, in particular diabetes. These poor diabetics are therefore included in our study population. Given the representativeness of the NSIF beneficiaries, compared to the rest of the

population, the partial nature of our study population cannot reasonably affect the validity of our results.

The main strength of our study is the estimation of the epidemiology of treated diabetes, all therapeutic modalities and all ages combined, on a large population estimated on average at more than 24 million 820 thousand NSIF beneficiaries and social security beneficiaries, during a period study which spanned 05 years for the estimation of prevalence (2010-2014).

Conclusion

The processing of imbursement data from the NSIF is now credible alternative for carrying out pharmacoepidemiological studies in response to the lack of data national, up-to-date and operational data to monitor the epidemiology of certain diseases, in particular diabetes. Our study, updating the data available to date on diabetes, allows to confirm the foreseeable increase in the prevalence of this pathology but also to provide new data relating to its characteristics of sex, age, treatment modalities and geographic disparities.

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